USER'S MANUAL

**Getting started with
ALEXAN ATMEL
AT89C2051/AT89C4051
Training Module - 1**

Version 1.0
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About This Guide

In this User's Manual, it is assumed that the user is familiar with microcontrollers on the following aspects:

1. How to program using an MCU programmer

2. MCU pin-outs and I/O port functions

3. How to use, program and control LED, 7-segment display, buzzer, relay, and serial port communication

4. How to read and interpret a schematic diagram

5. Knowledge on some electronic terms and devices

It is also assumed that the user is familiar in microcontroller programming either in C or assembly language. The user must have knowledge on compiling/debugging source codes. Moreover, it is also assumed that the user is knowledgeable on the standards and safety precautions in operating electronics hardware and correct handling of microcontrollers.

Alexan ATMEL AT89C2051/AT89C4051 Training Module – 1 and Alexan 89CX051 TM-1 refers to the same module and will be used alternately.

I. Overview

This user's manual will guide you on how to use the ALEXAN Training

Module 1 (TM-1).

The TM-1 is a helping tool in which you can explore the many features of a

microcontroller. This module uses ATMEL AT89C2051 and AT89C4051

microcontroller (MCU). This training module has the following applications:

1. 3-External Switches – INT0 (P3.2),INT1 (P3.3),T0 (P3.4)

2. 7-Segment Display

3. Buzzer

4. LEDs

5. Relay

6. RS232 Serial Communication

You must first be familiar with and understand the schematic diagram of the

training module to facilitate your programming.

II. Getting Started

What you need to get started

1. 2051 Training Module-1

2. 6 to 9V DC Power Adaptor

3. ATMEL AT89C2051/AT89C4051 Microcontroller

4. 3-Pin Connector to Serial Connector for RS232

5. ATMEL Programmer

6. Debugger/Compiler for your source code

After writing your hex code into the microcontroller by means of an IC programmer, insert your microcontroller into the 20-pin IC socket of your training module.
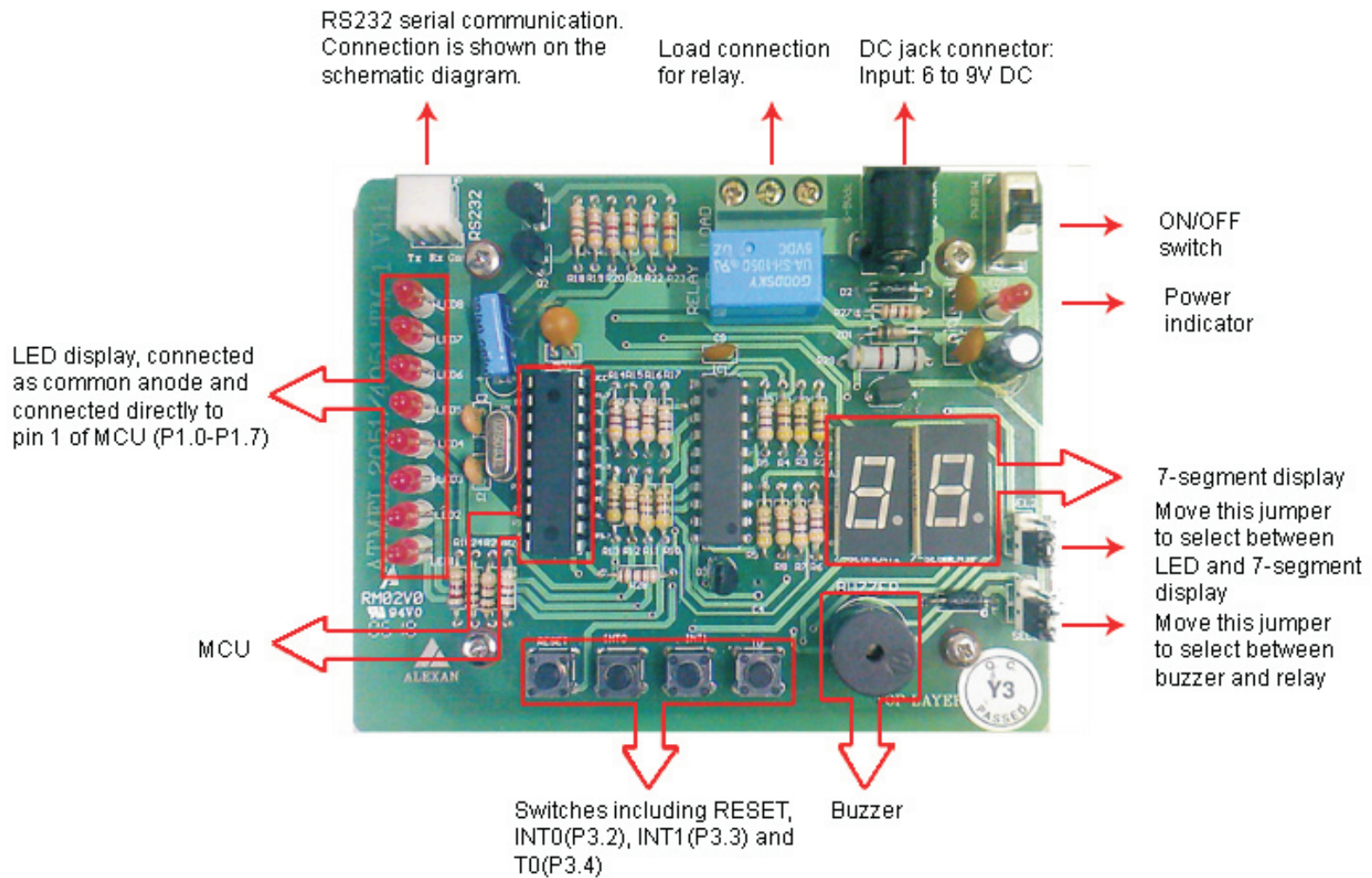
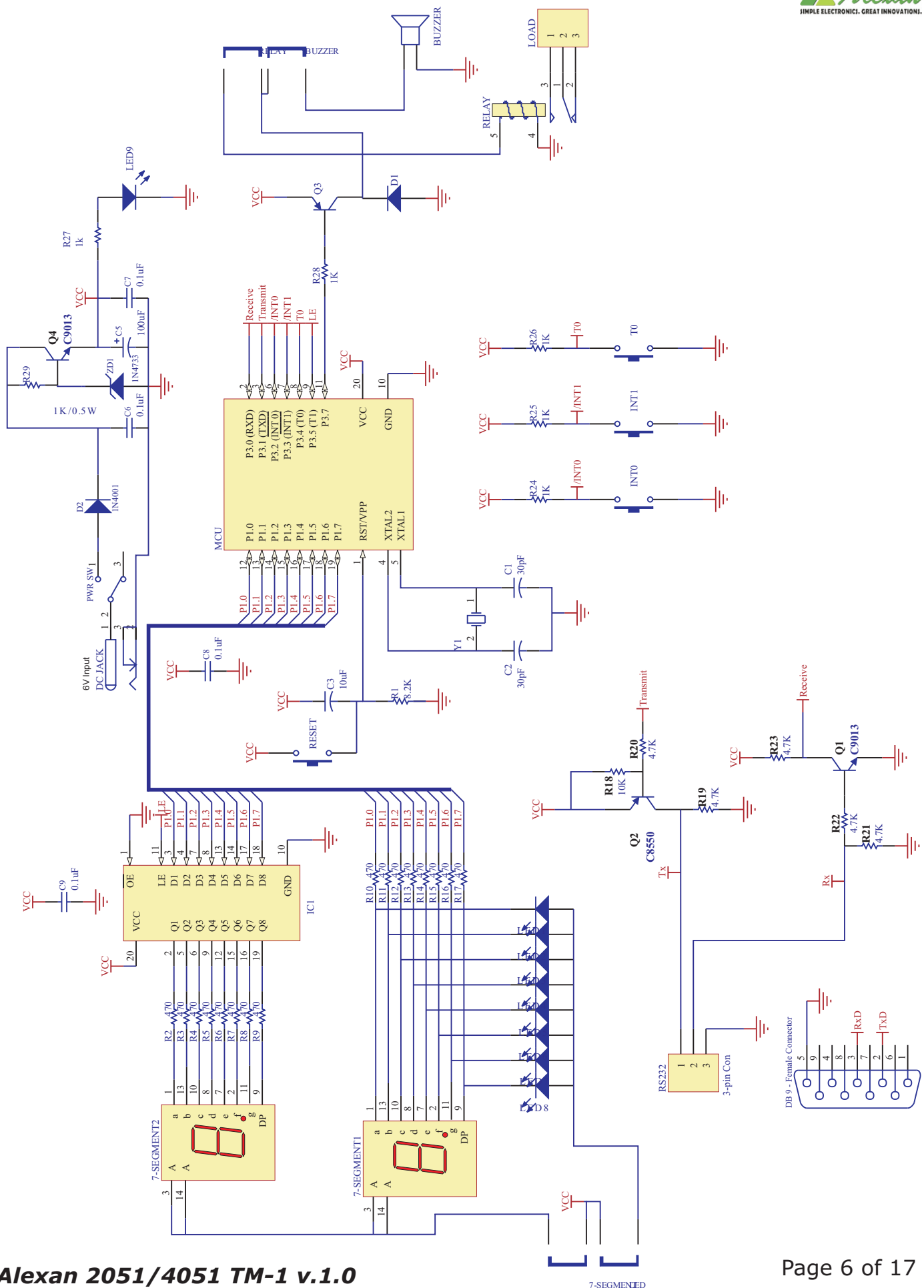**Note: The notch of the IC socket must correspond to the notch of your MCU. Incorrect placement may damage your MCU.**

Move the jumper of **SEL2** to select between LED display and 7-segment Display (both are connected as **Common Anode**). Likewise, move the jumper of **SEL1** to select between Buzzer andRelay application (a **0** or **LOW** pulse is used to activate buzzer and relay).

If you want to use the 2 digits of your 7-segment display, you can enable/disable the transparent latch IC (**74LS373**).
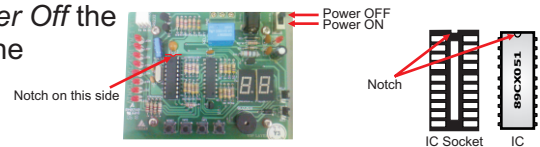
III. Training Module PCB and Schematic Diagram

RS232 serial communication. Connection is shown on the schematic diagram.

Load connection for relay.

DC jack connector: Input: 6 to 9V DC

ON/OFF switch

Power indicator

LED display, connected as common anode and connected directly to pin 1 of MCU (P1.0-P1.7)

7-segment display

Move this jumper to select between LED and 7-segment display

Move this jumper to select between buzzer and relay

MCU

Switches including RESET, INT0(P3.2), INT1(P3.3) and T0(P3.4)

Buzzer

Alexan 89CX051 TM-1 Schematic Diagram

Alexan 2051/4051 TM-1 v.1.0

IV. Operating Procedures for Demo Program

1. DEMO PROGRAM 1 - LED SEQUENCING

A. Burn the HEX file named "DEMO CODE - LED SEQUENCING.HEX" into the AT89C2051 IC using the Alexan ATMEL Programmer.
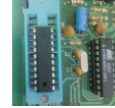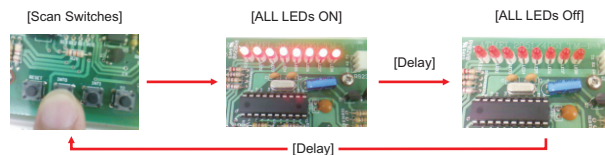

B. Transfer the programmed IC to the TM-1. Be sure to *Power Off* the module first. Make sure the IC is in the correct position. The notch of the IC must match the notch of the IC socket as shown in the picture.
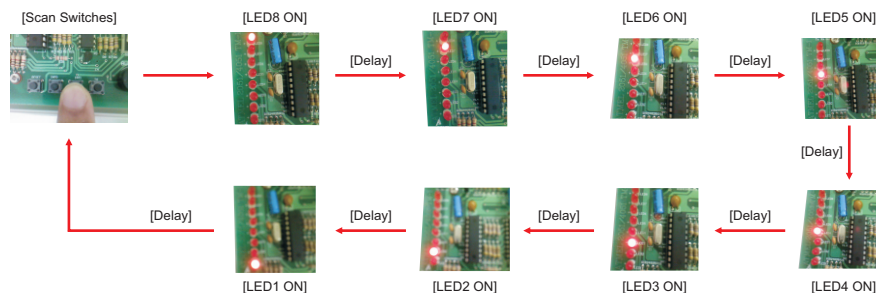

Power OFF
Power ON

Notch on this side

Notch

IC Socket   IC

C. Move the SEL2 jumper to LED. Plug-in the 6-9V DC into the DC jack and turn on the power.

All LEDs will be ON

DC Jack(6-9V DC)

Jumper must be on the LED position   Power ON
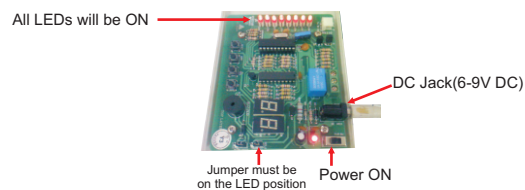
D. Press INT0 Switch to run LED Sequence 1.

[Scan Switches]   [ALL LEDs ON]   [Delay]   [ALL LEDs Off]

[Delay]

[Delay]

E. Press INT1 Switch to run LED Sequence 2.

[Scan Switches]   [LED8 ON]   [Delay]   [LED7 ON]   [Delay]   [LED6 ON]   [Delay]   [LED5 ON]

[Delay]

[LED1 ON]   [Delay]   [LED2 ON]   [Delay]   [LED3 ON]   [Delay]   [LED4 ON]

[Delay]

F. Press T0 Switch to run LED Sequence 3.

[Scan Switches]   [LED8+LED1 ON]   [Delay]   [LED7+LED2 ON]   [Delay]   [LED6+LED3 ON]   [Delay]   [LED5+LED4 ON]

[LED8+LED1 ON]   [Delay]   [LED7+LED2 ON]   [Delay]   [LED6+LED3 ON]   [Delay]
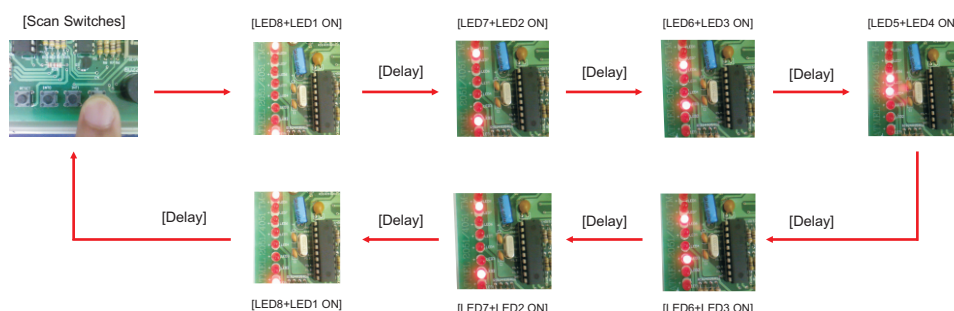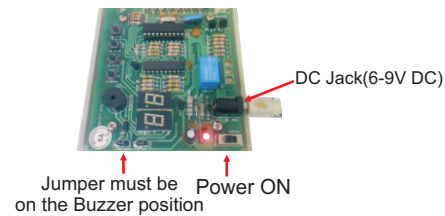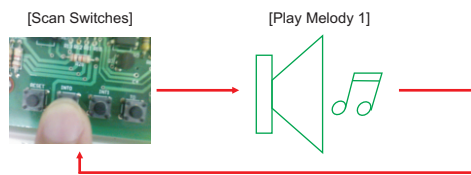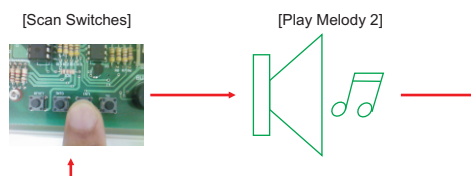
2. DEMO PROGRAM 2 - BUZZER

A. Burn the HEX file named "DEMO CODE - BUZZER.HEX" into the AT89C2051 IC using the Alexan ATMEL Programmer.

B. Transfer the programmed IC to the TM-1. Be sure to *Power Off* the module first. Make sure the IC is in the correct position. The notch of the IC must match the notch of the IC socket as shown in the picture.

Power OFF
Power ON
Notch on this side
Notch
IC Socket   IC
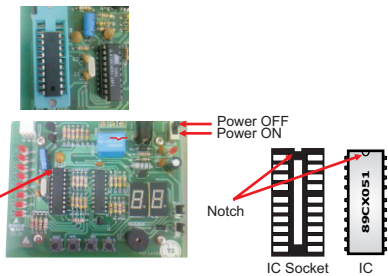
C. Move the SEL1 jumper to BUZZER. Plug-in the 6-9V DC into the DC jack and turn on the power.

DC Jack(6-9V DC)

Jumper must be   Power ON
on the Buzzer position

D. Press INT0 Switch to play Melody 1 ("Are You Sleeping?").

[Scan Switches]   [Play Melody 1]

E. Press INT1 Switch to play Melody 2 ("Twinkle Twinkle").

[Scan Switches]   [Play Melody 2]

F. Press T0 Switch to play Melody 3 ("Chinese Chime").
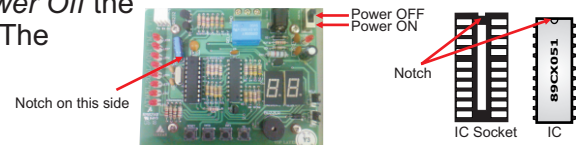
[Scan Switches]   [Play Melody 3]
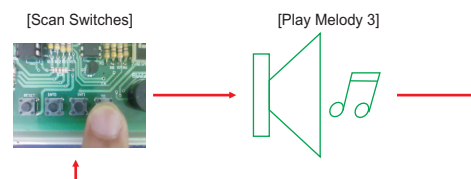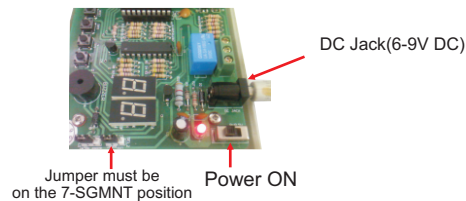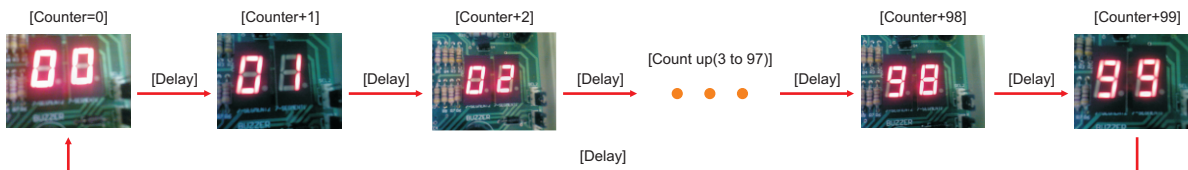
3. DEMO PROGRAM 3 - 7-SEGMENT DISPLAY

A. Burn the HEX file named "DEMO CODE - 7-SEGMENT DISPLAY.HEX" into the AT89C2051 IC using the Alexan ATMEL Programmer.
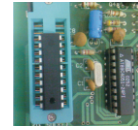
B. Transfer the programmed IC to the TM-1. Be sure to *Power Off* the module first. Make sure the IC is in the correct position. The notch of the IC must match the notch of the IC socket as shown in the picture.

Power OFF
Power ON

Notch

Notch on this side

IC Socket   IC

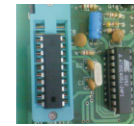C. Move the SEL2 jumper to 7-SGMNT. Plug-in the 6-9V DC into the DC jack and turn on the power.

DC Jack(6-9V DC)

Jumper must be
on the 7-SGMNT position

Power ON

D. The 7-segment will repeatedly count up from 0-99.

[Counter=0]		[Counter+1]		[Counter+2]		[Count up(3 to 97)]		[Counter+98]		[Counter+99]
	[Delay]		[Delay]		[Delay]	• • •	[Delay]		[Delay]	

[Delay]
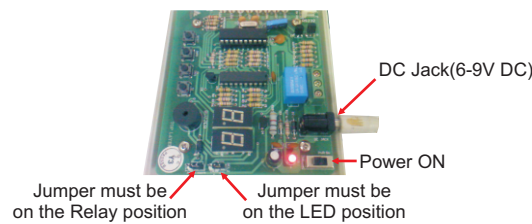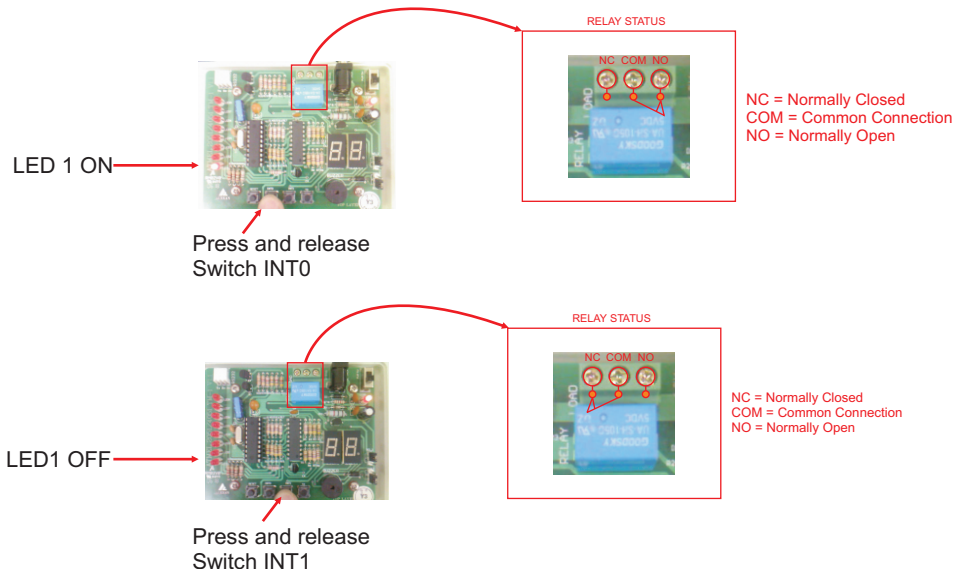
4. DEMO PROGRAM 4 -RELAY

A. Burn the HEX file named "DEMO CODE - RELAY.HEX" into the AT89C2051 IC using the Alexan ATMEL Programmer.

B. Transfer the programmed IC to the TM-1. Be sure to *Power Off* the module first. Make sure the IC is in the correct position. The notch of the IC must match the notch of the IC socket as shown in the picture.

Power OFF
Power ON

Notch on this side

Notch

IC Socket   IC
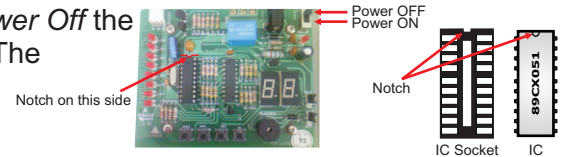
C. Move the SEL1 jumber to RELAY and SEL2 jumper to LED. Plug-in the 6-9V DC into the DC jack and turn on the power.

DC Jack(6-9V DC)

Power ON

Jumper must be on the Relay position

Jumper must be on the LED position

D. The RELAY will toggle ON and OFF if Switch INT0 and INT1 is pressed respectively.

RELAY STATUS

NC COM NO

NC = Normally Closed
COM = Common Connection
NO = Normally Open

LED 1 ON

Press and release Switch INT0

RELAY STATUS

NC COM NO

NC = Normally Closed
COM = Common Connection
NO = Normally Open

LED1 OFF

Press and release Switch INT1

5. DEMO PROGRAM 5 -RS232

A. Burn the HEX file named "DEMO CODE - RS232 WITH 7-SEG.HEX" into the AT89C2051 IC using the Alexan ATMEL Programmer.
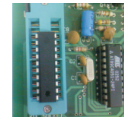
B. Transfer the programmed IC to the TM-1. Be sure to *Power Off* the module first. Make sure the IC is in the correct position. The notch of the IC must match the notch of the IC socket as shown in the picture.

Power OFF
Power ON

Notch on this side

Notch

IC Socket   IC
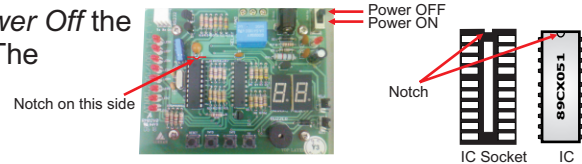
C. Move the SEL2 jumper to 7-SGMNT.
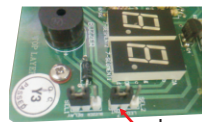
Jumper must be on the 7-SGMNT position

D. Connect the serial port of your PC as shown below.

1. Direct Connection.
   If your Personal Computer supports Serial Port, connect the TM-1 as shown below. The 3-pin connector of TM-1(labeled RS232) where each pin is labeled 2, 3 and 5 must be connected to the pins 2, 3 and 5 of your computer serial port respectively.

TM-1/TM-2

Back of PC: RS232 PORT
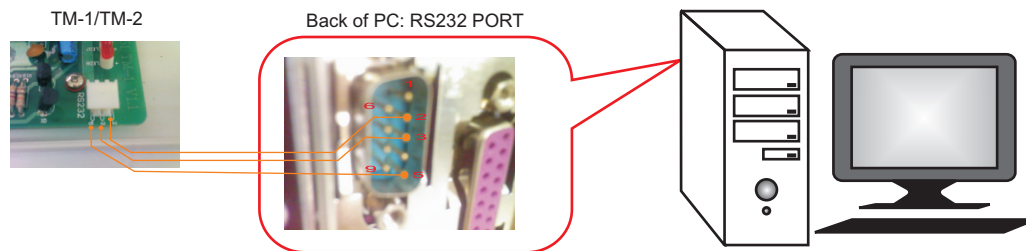
You can use a 3-pin connector (Female), RS232 9-pin connector (Female), and a MALE/FEMALE RS232 Cable to simplify the above connection.

TM-1/TM-2   RS232 CABLE   Back of PC: RS232 PORT

Internal connection of Rs232 CABLE
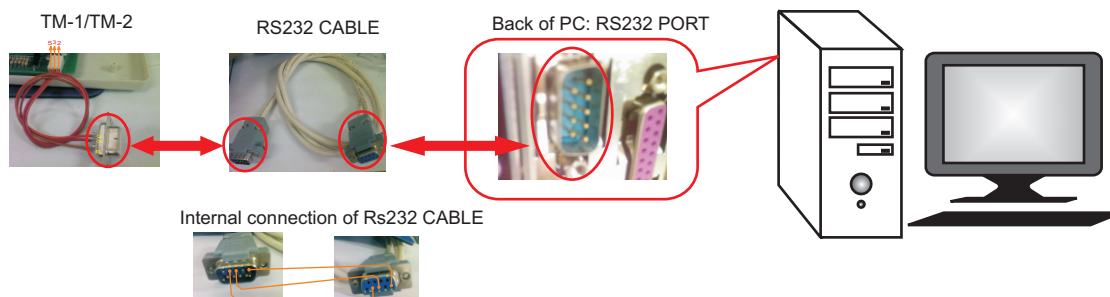
Note: You can leave pins 1,4,6,7,8 and 9 unconnected, they are not useful in our application or you can also connect them, as long as they are connected 1-to-1(Pin 1 Male to Pin 1 Female, Pin 4 Male to Pin 4 Female, and so on).

2. Using a USB to RS232 Converter.

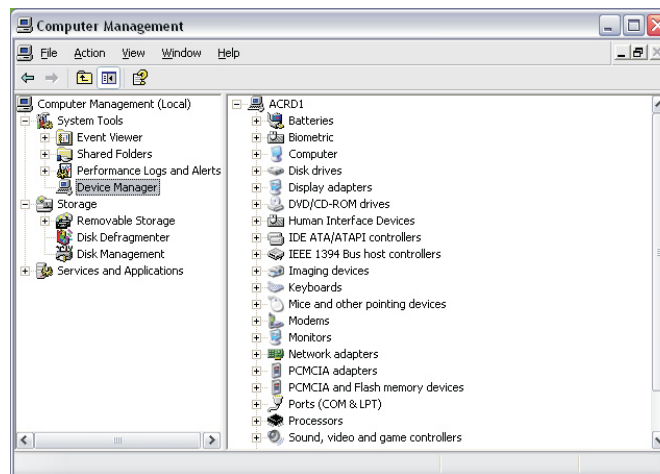TM-1/TM-2   USB TO RS232 CONVERTER

Back of PC: USB PORT
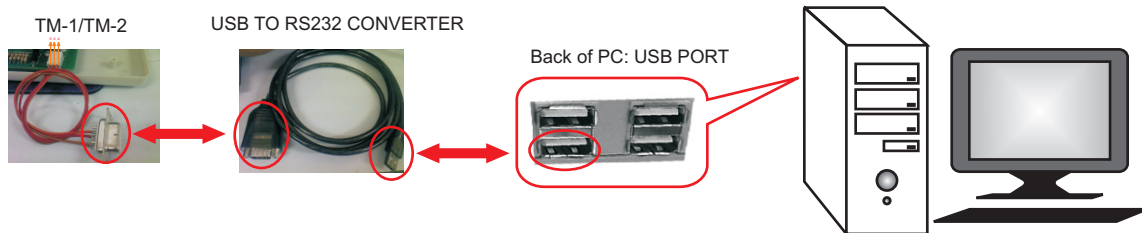
Note: You can use any working USB to RS232 Converter, but first you must install the driver and locate its COM port number. The COM port number of your serial port must be known for this application.

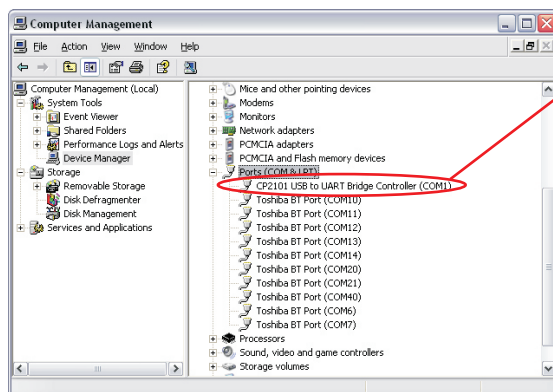## E. Locate the COM port number of your serial port.

1. Right-click on "My Computer" and click "Manage".
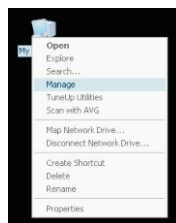
2. Click "Device Manager".

3. Double-click the "Ports (COM & LPT)" to view the list of connected devices.

Sample COM port number for USB to serial converter. In this example, the converter is located on COM port 1. Take note that the driver of your USB to serial converter automatically assigns the COM port number, so you must identify the one you are using.

Note: Majority of the built-in serial port is designated as COM1.

F. To run the RS232 demo code, the HyperTerminal program will be used. HyperTerminal is included in the Windows Operating System.
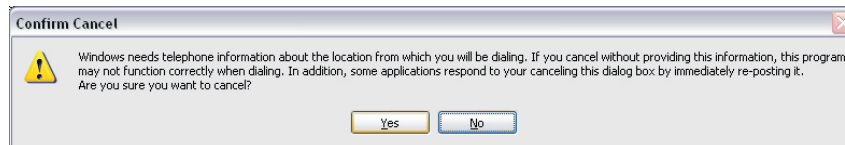
    1. Open HyperTerminal.
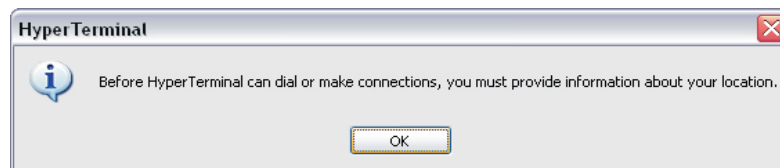   To open the HyperTerminal, click "Start > All Programs > Accessories > Communications > HyperTerminal"

    2. If prompted with the Location Information, click "Cancel".
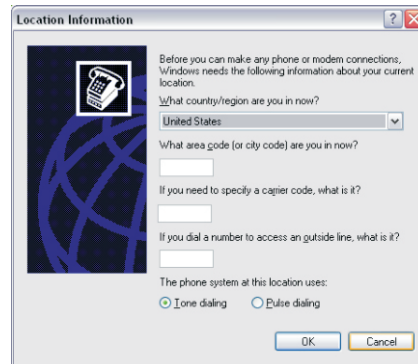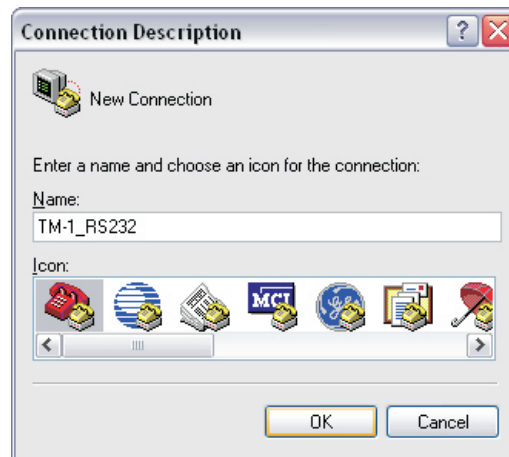

    3. Click "Yes" to confirm.

    4. Click "OK".

    5. In the Name box, type a name that describes your connection as shown in the example below, then click "OK".
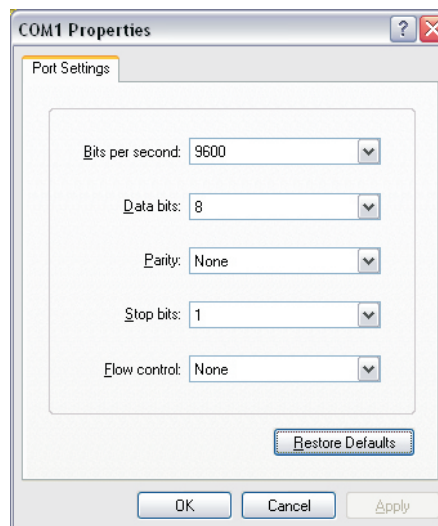
6. In the Connect To dialog box, choose the port number of your Serial Port or USB to Serial converter using drop down box to connect to TM-1.
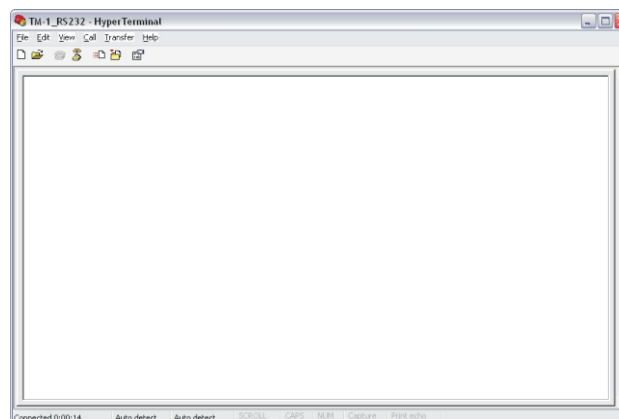

7. In the COM Port Properties, set the following values listed below to set your Port Settings and click "OK":

Bits per second: 9600
Data bits: 8
Parity: None
Stop bits: 1
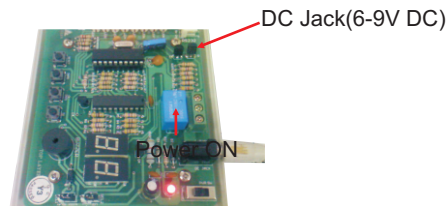Flow Control: None

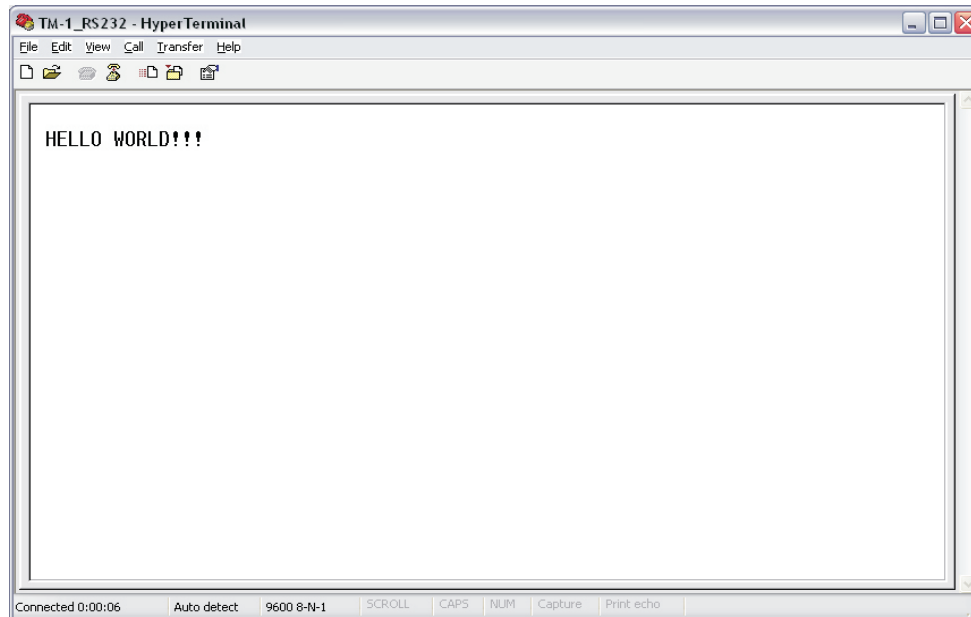You have successfully loaded and configured the HyperTerminal!

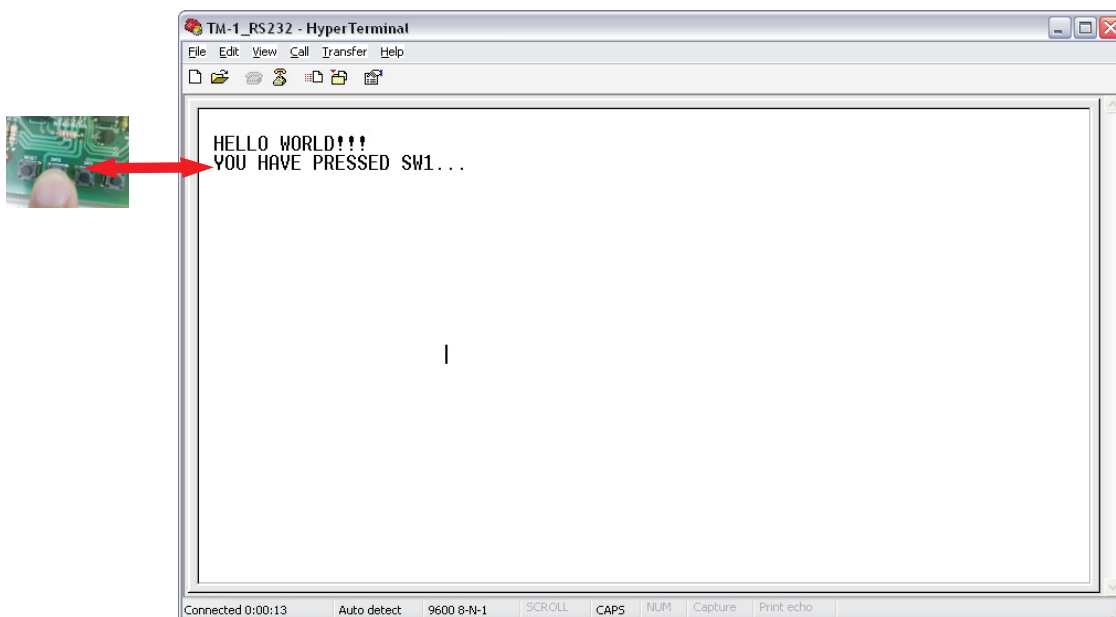8. To start running the demo code, do the following step:

A. Turn ON TM-1.

DC Jack(6-9V DC)

Power ON

A message "HELLO WORLD" will immediately appear on the HyperTerminal window.

B. If you pressed Switch INT0, a message "YOU HAVE PRESSED SW1" will appear on the HyperTerminal window indicating that TM-1's Switch1 (INT0) was pressed.

C. If you pressed Switch INT1, a message "YOU HAVE PRESSED SW2" will appear on the HyperTerminal window indicating that TM-1's Switch2 (INT1) was pressed.
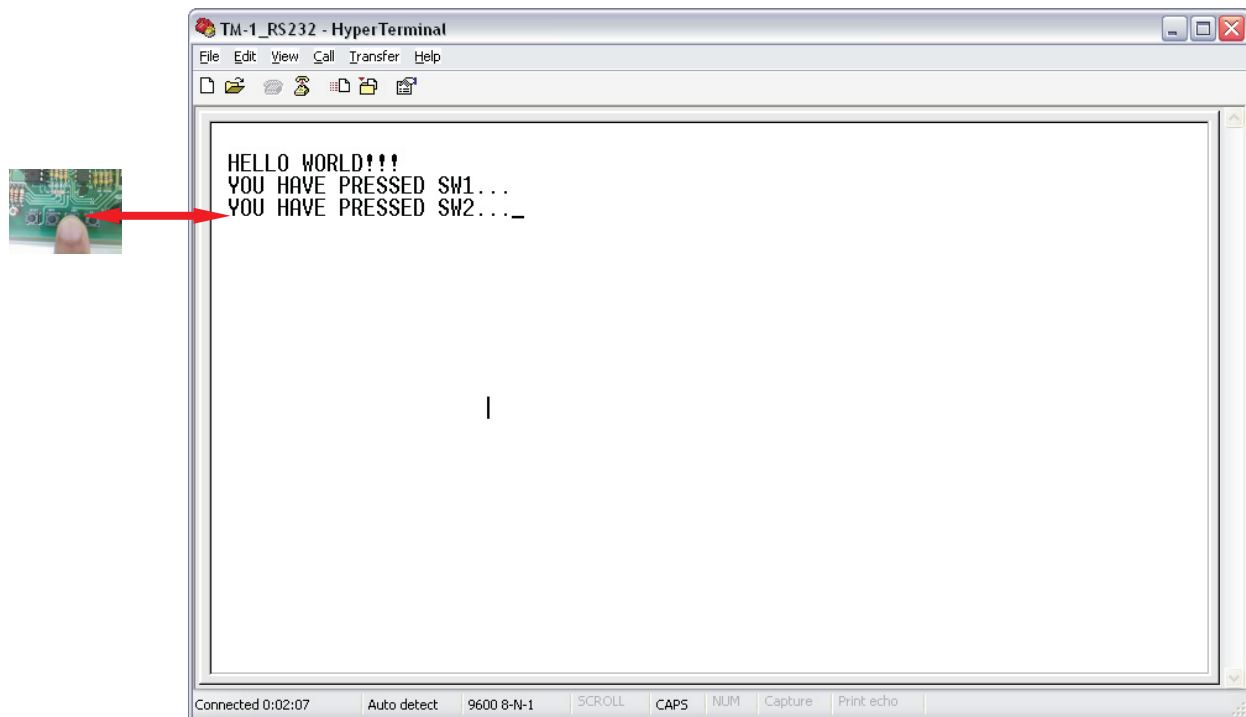
D. If you pressed Switch T0, a message "YOU HAVE PRESSED SW3" will appear on the HyperTerminal window indicating that TM-1's Switch3 (T0) was pressed.
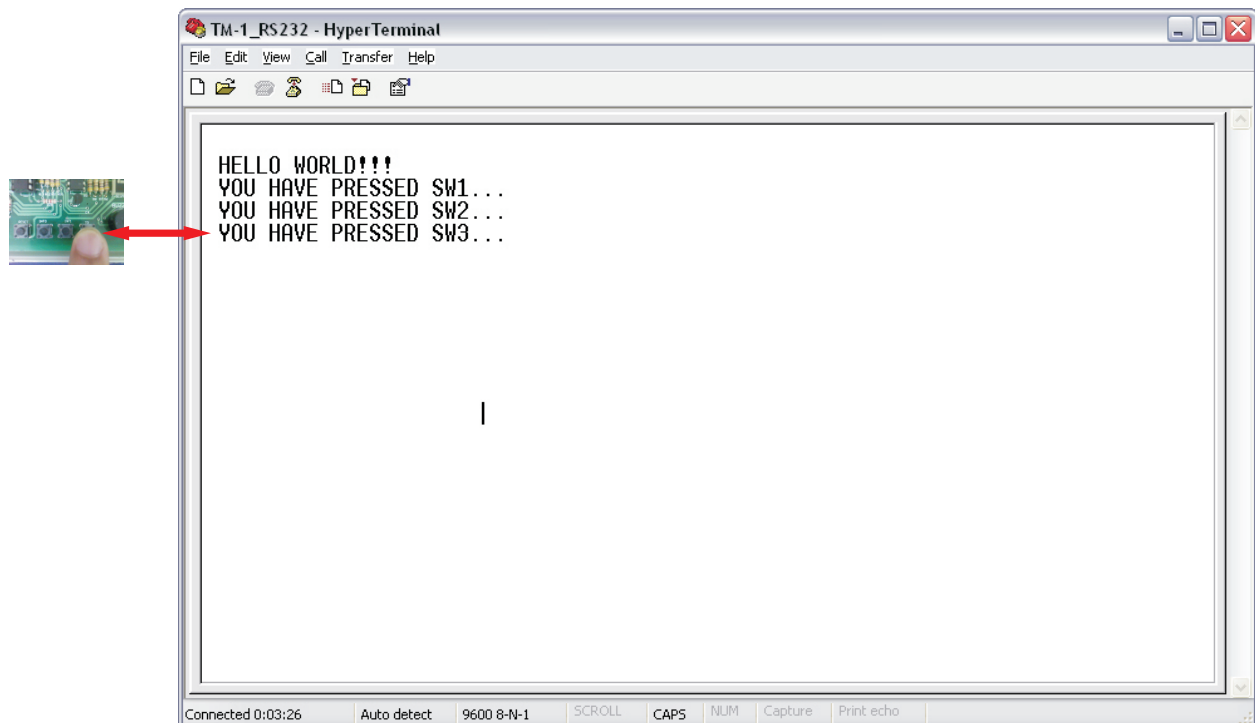
E. In the previous example, TM-1 communicated with HyperTerminal. In the next example, the HyperTerminal will communicate with TM-1. By pressing keys 0 to 9 and A to F of your keyboard, each character pressed will be immediately sent to TM-1 and displayed on 7-SEGMENT1 as shown below.